

**IN THE CLAIMS:**

Claims 1 – 23 (Withdrawn)

- 1    24.    (Currently Amended) A direct oxidation fuel cell, comprising:  
2                    (A)    a membrane electrode assembly disposed within a fuel cell hous-  
3                    ing, including  
4                    (i)    a protonically conductive, electronically non-conductive  
5                    membrane electrolyte having an anode face and an opposing cathode face;  
6                    (ii)    an anodic metallic diffusion layer disposed generally par-  
7                    allel to said anode face of said membrane electrode assembly and having a  
8                    plurality of openings therein, [[to allow]] said openings being of a size so  
9                    as limit mass transport of an associated fuel substance [[to pass]] there-  
10                   through to said anode face of said membrane electrode assembly to pro-  
11                   duce [[said]] electricity generating reactions [[and to allow electrons]] and  
12                   to allow the mass transport of carbon dioxide produced in said reactions  
13                   [[to travel]] away from said membrane electrode assembly;  
14                   (iii)    an anode catalyst disposed generally between said anode  
15                   face and said anodic metallic diffusion layer, and a cathode catalyst dis-  
16                   posed generally between said cathode face of the protonically conductive,  
17                   electronically non-conductive membrane electrolyte, and a cathode side of  
18                   said housing, whereby electricity-generating reactions occur upon intro-  
19                   duction of said associated fuel substance including anodic disassociation  
20                   of said fuel substance into carbon dioxide, protons and electrons, and a  
21                   cathodic combination of protons, electrons and oxygen from an associated  
22                   source of oxygen, producing water; and  
23                   (B)    a load coupled across an anode and cathode of said fuel cell, pro-  
24                   viding a path for said electrons produced at the anode by said electricity-  
25                   generating reactions, to the cathode.

1 25. (Previously Presented) The direct oxidation fuel cell as defined in claim 24  
2 wherein

3 said openings in said anodic metallic diffusion layer comprise a plurality of pores  
4 formed in said anodic metallic diffusion layer.

1 26. (Previously Presented) The direct oxidation fuel cell as defined in claim 24  
2 wherein said anodic metallic diffusion layer comprises a porous metal that has openings  
3 therein to allow substances to pass through said openings.

1 27. (Previously Presented) The direct oxidation fuel cell as defined in claim 24  
2 wherein said anodic metallic diffusion layer is at least partially comprised of at least one  
3 of titanium, chromium, stainless steel and other alloys, or combinations thereof.

1 28. (Previously Presented) The direct oxidation fuel cell as defined in claim 24  
2 wherein said anodic metallic diffusion layer is at least partially comprised of a metallic  
3 material that does not substantially react with methanol, or other reactants and by prod-  
4 ucts of the electricity generating reactions.

1 29. (Currently Amended) The direct oxidation fuel cell as defined in claim 24  
2 wherein  
3 said anodic metallic diffusion layer comprises a composition of [[loose]] pieces of  
4 metal bonded together that have spaces therebetween allowing substances to pass be-  
5 tween the interstices formed by said spaces between metal pieces. ,

1 30. (Currently Amended) The direct oxidation fuel cell as defined in claim 24  
2 wherein said anodic metallic diffusion layer is treated with a substance that renders at  
3 least a portion of the anodic metallic diffusion layer at least partially hydrophobic to con-  
4 trol the flow of water while allowing the flow of gases.

1 31. (Currently Amended) The direct oxidation fuel cell as defined in claim 24  
2 wherein said anodic metallic diffusion layer is treated with a substance that renders at  
3 least a portion of the anodic metallic diffusion layer at least partially hydrophilic to en-  
4 courage the flow of at least one of fuel and water.

1 32. (Currently Amended) The direct oxidation fuel cell as defined in claim 24  
2 wherein said anodic metallic diffusion layer is treated with a substance that renders a first  
3 portion of the layer hydrophobic and a second portion of the layer hydrophilic, to allow  
4 for the flow of water and fuel and the flow of gases in proportion to the portion that is  
5 hydrophilic and hydrophobic, respectively, throughout the anodic metallic diffusion  
6 layer.

1 33. (Previously Presented) The direct oxidation fuel cell as defined in claim 25  
2 wherein said pores are of more than one dimension.

1 34. (Previously Presented) The direct oxidation fuel cell as defined in claim 33  
2 wherein a group of said pores formed in said anodic metallic diffusion layer are of a  
3 larger size than a remaining group of said pores, and at least some of the pores of said  
4 larger size are treated with a hydrophilic material.

1 35. (Previously Presented) The direct oxidation fuel cell as defined in claim 34  
2 wherein at least some of said remaining group of pores are treated with a hydrophobic  
3 material.

1 36. (Currently Amended) The direct oxidation fuel cell as defined in claim 33  
2 wherein at least some of said pores of said layer are treated with [[Nafion]], NAFION®  
3 or a substance that renders treated pores at least partially hydrophilic.

1 37. (Currently Amended) The direct oxidation fuel cell as defined in claim 33  
2 wherein at least some of said pores of said layer are treated with [[Teflon]], TEFLON®  
3 or other hydrophobic agent to render treated pores at least partially hydrophobic.

1 38. (Currently Amended) The direct oxidation fuel cell as defined in claim 29  
2 wherein said [[loose]] pieces of metal are bonded together by particle diffusion bonding  
3 techniques.

1 39. (Previously Presented) The direct oxidation fuel cell as defined in claim 38  
2 wherein said particles are treated by at least one of a hydrophobic substance and a hydro-  
3 philic substance.

1 40. (Previously Presented) The direct oxidation fuel cell as defined in claim 24,  
2 wherein a first portion of said layer is treated with a hydrophobic substance, and a second  
3 portion of said layer is treated with a hydrophilic substance, to form a pattern in said me-  
4 tallic diffusion layer of areas of relative hydrophobicity and areas of relative hydrophilic-  
5 ity, to provide discrete paths through the metallic diffusion layer through which gaseous  
6 and liquid reactants and byproducts can pass.

1 41. (Previously Presented) The direct oxidation fuel cell as defined in claim 24,  
2 further comprising:  
3 a flow field plate disposed generally parallel to said anodic metallic diffusion  
4 layer, said flow field plate having channels formed therein to direct the flow of sub-  
5 stances within said fuel cell across said anodic metallic diffusion layer.

1 42. (Previously Presented) The direct oxidation fuel cell as defined in claim 24  
2 wherein  
3 said anodic metallic diffusion layer performs as a flow field plate and current  
4 collector to conduct electrons produced in said electricity generating reactions and said

5 load being coupled to said anodic metallic diffusion layer to provide a path for said elec-  
6 trons out of said fuel cell as the electricity is produced by said fuel cell.

1 43. (Previously Presented) The direct oxidation fuel cell as defined in claim 42  
2 wherein  
3 said anodic metallic diffusion layer performing as said flow field plate and current  
4 collector includes channels formed therein to direct the flow of fuel to said anode face of  
5 said membrane electrode assembly.

1 44. (Currently Amended) The direct oxidation fuel cell as defined in claim 24 further  
2 comprising  
3 a cathodic metallic diffusion layer disposed generally parallel to said cathode face  
4 of said membrane electrode assembly and having a plurality of openings therein, said  
5 openings being sized to limit the transport of oxygen to said cathode face [[to allow oxy-  
6 gen to pass therethrough to said cathode face]] of said membrane electrode assembly, and  
7 to control water in said fuel cell. [[to travel away from said membrane electrode assem-  
8 bly]].

1 45. (Currently Amended) The direct oxidation fuel cell as defined in claim 44  
2 wherein  
3 said openings in said cathodic metallic diffusion layer comprise a plurality of  
4 pores formed in said cathodic metallic diffusion layer, said pores being sized to limit the  
5 water released from the cathode aspect of the fuel cell.

1 46. (Currently Amended) The direct oxidation fuel cell as defined in claim 44  
2 wherein  
3 said cathodic metallic diffusion layer comprises a porous metal that has openings  
4 therein that allow substances to pass through said openings, said openings being sized to  
5 limit the water that is released from the cathode aspect of the fuel cell.

1 47. (Previously Presented) The direct oxidation fuel cell as defined in claim 44  
2 wherein

3 said cathodic metallic diffusion layer comprises a porous metal that has openings  
4 therein that allow removal of liquids from, and allow introduction of gases to the mem-  
5 brane electrode assembly.

1 48. (Currently Amended) The direct oxidation fuel cell as defined in claim 44  
2 wherein said cathodic metallic diffusion layer is at least in part comprised of a material  
3 selected from the group consisting of nickel, copper, titanium, chromium, steel, stainless  
4 steel, and other [[suitable]] alloys and combinations thereof.

1 49. (Previously Presented) The direct oxidation fuel cell as defined in claim 44  
2 wherein said cathodic metallic diffusion layer is at least in part comprised of a material  
3 that does not substantially react with byproducts or substances, present on the cathode of  
4 the fuel cell.

1 50. (Currently Amended) The direct oxidation fuel cell as defined in claim 44  
2 wherein  
3 said cathodic metallic diffusion layer comprises a composition of [[loose]] pieces  
4 of metal bonded together that have spaces therebetween allowing substances to pass  
5 through the interstices formed by said spaces between said metal pieces, the spaces being  
6 sized to control the flow of water in said fuel cell.

1 51. (Previously Presented) The direct oxidation fuel cell as defined in claim 44  
2 wherein said cathodic metallic diffusion layer is treated with a substance that renders the  
3 layer at least partially hydrophobic, to allow the introduction of gases to the membrane  
4 electrode assembly.

1 52. (Previously Presented) The direct oxidation fuel cell as defined in claim 44  
2 wherein said cathodic metallic diffusion layer is treated with a substance that renders the

3 layer at least partially hydrophilic, to allow the removal of liquids from the cathode face  
4 of the membrane electrode assembly.

1 53. (Currently Amended) The direct oxidation fuel cell as defined in claim 44  
2 wherein said cathodic metallic diffusion layer is treated with a first substance that renders  
3 a first portion of the cathodic metallic diffusion layer hydrophobic and a second sub-  
4 stance that renders a second portion of the cathodic metallic diffusion layer hydrophilic,  
5 to balance the flow of water and the flow of gases throughout the cathodic metallic diffu-  
6 sion layer.

1 54. (Previously Presented) The direct oxidation fuel cell as defined in claim 44  
2 further comprising a second flow field plate that is disposed generally parallel to said ca-  
3 thodic metallic diffusion layer.

1 55. (Previously Presented) The direct oxidation fuel cell as defined in claim 44  
2 wherein  
3 said cathodic metallic diffusion layer performs as a flow field plate and current  
4 collector, and said load being coupled to said cathodic metallic diffusion layer to provide  
5 a path for electrons to travel to the cathode where it combines with oxygen at said cath-  
6 ode side of said fuel cell, producing water.

1 56. (Previously Presented) The direct oxidation fuel cell as defined in claim 55  
2 wherein  
3 said cathodic metallic diffusion layer performing as said flow field plate and cur-  
4 rent collector has channels formed therein to direct the flow of oxygen across the cathode  
5 face of said membrane electrode assembly.

1 57. (Previously Presented) The direct oxidation fuel cell as defined in claim 24  
2 wherein said anodic metallic diffusion layer is at least in part comprised of a material  
3 having properties that improve conductivity.

1 58. (Previously Presented) The direct oxidation fuel cell as defined in claim 24  
2 wherein said anodic metallic diffusion layer is treated or coated with a material to provide  
3 improved conductivity.

1 59. (Previously Presented) The direct oxidation fuel cell as defined in claim 44  
2 wherein said cathodic metallic diffusion layer is at least in part comprised of a material  
3 having properties that improve conductivity.

1 60. (Previously Presented) The direct oxidation fuel cell as defined in claim 24  
2 wherein said cathodic metallic diffusion layer is treated or coated with a material to pro-  
3 vide improved conductivity.

1 61. (Previously Presented) The direct oxidation fuel cell as defined in claim 24  
2 wherein  
3 said fuel substance is a liquid carbonaceous fuel substance.

1 62. (Previously Presented) The direct oxidation fuel cell as defined in claim 24  
2 wherein  
3 said fuel substance is selected from the group consisting of methanol, ethanol,  
4 propanol, butanol and aqueous solutions thereof and combinations thereof.

Claims 63-110 (Withdrawn).

1 111. (New) The direct oxidation fuel cell as defined in claim 24 further comprising:  
2 an additional layer, disposed between said anodic metallic diffusion layer  
3 and said anode catalyst, of at least one of the following:  
4 (i) carbon paper; and  
5 (ii) carbon cloth.



1 112. (New) The direct oxidation fuel cell as defined in claim 44 further comprising:  
2 an additional layer, disposed between said cathodic metallic diffusion  
3 layer and said cathode catalyst, of at least one of the following:

- 4 (i) carbon paper; and  
5 (ii) carbon cloth.

1 113. (New) The direct oxidation fuel cell as defined in claim 44 wherein said cathodic  
2 metallic component is substantially hydrophilic.